

C. REMARKS / ARGUMENTS**1. Amendment to Independent Claim 1 and Cancellation of Claim 5**

Independent claim 1 has been amended (and claim 5 has been canceled), as set forth in section B above, in order to more clearly distinguish the claimed subject matter from the prior art references cited by the Examiner.

Claim 1 has been amended to state that the noise-reduction pre-processor in the data processing system is configured to generate a noise-reduced signal from the averaged signal. Claim 1 has been further amended to state that the data processing system includes a spectral estimator configured to generate a spectrum for the sample by converting said noise-reduced signal into a frequency domain. (This limitation had previously been set forth in claim 5, which is hereby canceled.)

No new matter is added by the above amendments, support for which can be found throughout Applicant's specification.

2. Examiner's Response to Arguments, pp. 2-4 of the Office Action of September 11, 2007

In ¶ 2 of the Office Action, on page 2 of the Examiner's Response to Arguments, the Examiner sets forth reasons why claim 1, part a¹ is taught by Smith.

In response, Applicant submits that claim 1, part a is not one of the limitations of claim 1 that Applicant distinguished over Smith, in Applicant's Response to Office Action of June 25, 2007. (See p. 16 of Applicant's June 25 2007 Response to Office Action, in which Applicant listed the claim limitations that are not taught or suggested in Smith. Part a of claim 1 is not one of them.) In

¹ Claim 1 part a states: "a data acquisition system configured to measure a signal emitted from the sample in response to excitation energy applied thereto, and to average the measured signal over a plurality of measurements to generate an averaged signal for the sample"

other words, Applicant does not argue, nor did Applicant previously argue, that part a of claim 1 is what distinguishes claim 1 over Smith.

In ¶ 2 of the Office Action, on page 3 of the Examiner's Response to Arguments, the Examiner discusses limitation b) of claim 1,² and concludes that "Smith teaches these limitations." Applicant respectfully traverses.

Not only is such a conclusion by the Examiner wrong, but also the Examiner's discussion of limitation b) of claim 1 is strikingly incomplete. The only features of limitation b) of claim 1 that the Examiner mentions in paragraph 2 (page 3) of the Office Action is "a vector space derived from FID measurements." Limitation b) of claim 1 pertains to much more than that, however. Among other things, Claim 1 limitation b) also recites, a noise-reduction pre-processor, a noise-free signal subspace, a noise subspace, noise-free singular values, and noise singular values. None of these features are taught or suggested in Smith.

As explained in detail in Prof. Taylor's Declaration ("Declaration"), filed concurrently herewith, Smith does not perform the PCA procedure (discussed at length in Smith, and involving the creation of certain vector spaces), or any other mathematical or numerical procedure, in order to reduce or remove noise from the signals. See e.g. Declaration, ¶¶ 29-30.

² Limitation b) of Claim 1, as currently amended, states:

a data processing system including:

a noise-reduction pre-processor configured to generate a noise-reduced signal from the averaged signal by creating a vector space from said averaged signal, and generating one or more singular values and corresponding eigenvectors of a correlation matrix constructed within said vector space, said vector space containing a noise-free signal subspace and a noise subspace, said singular values including noise-free singular values associated with said noise-free signal subspace, and noise singular values associated with said noise subspace; and

a spectral estimator configured to generate a spectrum for the sample by converting said noise-reduced signal into a frequency domain;

While Smith does teach the creation of certain vector spaces, vector space creation is merely a very commonly used mathematical tool that was known for many years, and is standard textbook material that is taught in many modern mathematics books. Declaration, ¶ 32. A great many patents and publications, other than Smith, disclose or use the creation of vector spaces.

What Smith does not teach is a noise-reduction pre-processor configured to generate a noise-reduced signal from the averaged signal by creating a vector space from said averaged signal and generating one or more singular values ... said vector space containing a noise-free signal subspace and a noise subspace, said singular values including noise-free singular values associated with said noise-free signal subspace, and noise singular values associated with said noise subspace, as recited in limitation b) of claim 1 (but not discussed by the Examiner in ¶ 2 of the Office Action). As emphasized in the Declaration (see e.g. paragraph 30 of the Declaration), Smith does not associate any singular values with noise. Also, nowhere does Smith teach noise-free singular values (associated with a noise-free signal subspace) or noise singular values (associated with a noise subspace).

Further, part b) of claim 1 has been amended to include the limitation that the data processing system include a spectral estimator configured to generate a spectrum for the sample by converting said noise-reduced signal into a frequency domain. As explained in the Declaration (see e.g. paragraph 24), Smith does not teach or suggest converting signals into a spectrum. In fact, Smith does not even look at any spectrum. There is no way Smith can teach or suggest a spectral estimator configured to generate a spectrum for the sample by converting said noise-reduced signal into a frequency domain.

For these reasons, Applicant respectfully traverses the Examiner's conclusion, and submits that limitation b) of claim 1 is neither taught nor suggested in Smith.

In the remaining portion of ¶ 2 of the Office Action, spanning pages 3 and 4 of the Office Action, the Examiner discusses limitations b), d), f), and h), set forth in Applicant's previously filed Response, and set forth again below for the Examiner's convenience. Applicant respectfully traverses.

Limitations b), d), f), and h) that were set forth in Applicant's previous Response state as follows:

- b) *"a control system configured to identify, in a graph of the singular values of the correlation matrix constructed within the vector space created from the averaged signal, a gap between a smallest noise-free singular value and a first noise singular value"* (Claim 1)
- d) *"a first processing system for identifying, in a graph of the singular values of the harmonic inversion correlation matrix, a gap between a noise-free singular value ... and an adjacent noise singular value"* (Claim 14)
- f) *"identify, in a graph of the singular values of the harmonic inversion correlation matrix, a gap between a noise-free singular value ... and an adjacent noise singular value"* (Claim 15)
- h) *"determine whether a gap appears between a noise-free singular value and an adjacent noise singular value in a plot of said singular values"* (Claim 17)

As explained in detail in the Declaration, none of the limitations b), d), f), and h) are either taught or suggested in Smith. Contrary to the Examiner's comments on the last portion of paragraph 2 of the Office Action, Smith does not in any way teach, suggest, or relate to noise-free singular values (associated with a noise-free signal subspace) or noise singular values (associated with a noise subspace), let alone any gap between them. Declaration, ¶ 30. Any association of noise with the mathematical procedures discussed in Smith is false and non-existent. Declaration, ¶ 30.

As explained in the Declaration (see e.g. paragraphs 29, 30, and 33), Smith has nothing whatsoever to do with the subject matter recited in the above

limitations b), d), f), and h), namely identifying a gap between a noise-free singular value and a noise singular value, in a graph of the singular values. Absolutely nowhere does Smith teach or suggest a gap between a noise-free singular value and a noise singular value, in a graph of singular values.

For these reasons, Applicant respectfully submits that, contrary to the Examiner's statements in ¶ 2, pages 3 and 4, of the Office Action Smith neither teaches nor suggests limitations b), d), f), and h).

Regarding limitations c), e), g), and i) set forth in page 18 of Applicant's previously filed Response, the Examiner did not address them in his Response to Arguments section (paragraphs 1, 2, 3, and 4) of the Office Action.

2. Rejection of Claims 1-4, 6, 14-17, and 25-28 Under 35 U.S.C. 103

Claims 1-4, 6, 14-17, and 25-28 stand rejected under 35 U.S.C. 103 as unpatentable over US Pat. No. 5,420,508 to Smith et al. ("Smith") in view of US Pat. No. 5,148,379 to Konno et al. ("Konno"). Applicant respectfully traverses.

Independent Claims 1, 14-17, and 25-28

Amended independent claim 1, as well as independent claims 14-17 and 25-28, are clearly distinguishable from Smith and Konno, neither of which has anything to do with the subject matter recited in these independent claims. Declaration, ¶¶ 24, 33, and 34. In particular, nowhere does Smith or Konno, either alone or in combination, teach, suggest, or disclose identifying a gap between a noise-free singular value and a noise singular value, in a graph of the singular values, as a criterion for determining whether a sufficient number of measurements have been made and therefore no further measurements need be taken. Declaration, ¶¶ 33 and 37.

The detailed statements made by the Examiner on pages 5-8 of the Office Action regarding claims 1 and 14-17 and are either wrong³, or irrelevant because they relate to subject matter not recited in the claims at issue.⁴

Regarding claims 25-28, the Examiner merely refers in page 8 of the Office Action to "the preceding argument," without further elaboration, and concludes that Smith teaches the features of claims 25-28.

For reasons explained above and supported by the Declaration, none of the features of claims 25-28 are taught or suggested in any way by Smith.

In order to establish a *prima facie* case of obviousness, at least the following condition must be satisfied: The prior art reference(s) must teach or suggest all of the elements and limitations recited in the claims. As explained above, neither Smith and Konno, either alone or in combination, teach or suggest all the limitations of any one of the claims 1, 14-17, and 25-28. Specifically, none of the limitations of parts b) and c) of claim 1 are taught or suggested in either Smith or Konno, and none of the limitations of 14-17, and 25-28 are taught or suggested in either Smith or Konno. The subject matters of Smith and Konno are completely unrelated to the present application. Declaration, ¶¶ 24, 33, and 34.

For these reasons, independent claims 1, 14-17, and 25-28 are not obvious over Smith and Konno under 35 U.S.C. § 103, because no *prima facie* case of obviousness can be established.

Claims 2-4, and 6

³ As just one example, the statement by the Examiner that "*Smith teaches that the control system performs additional measurements when the gap is not defined, or the statistical fit provides erroneous errors, and prevents further measurements when the gap is stable,*" is wrong: nowhere does Smith teach or suggest, in any shape or form, such features.

⁴ As just one example, the statement by the Examiner that "*It would have been obvious ... to combine the teachings of Smith and Konno for the purpose of verifying the accuracy of the system ... and aiding in the visualization of scientific data*" is irrelevant to the claims at issue, because neither "verifying the accuracy of the system" nor "aiding in the visualization of scientific data" are recited in any of the claims at issue.

Claims 2-4 and 6 depend on claim 1. For reasons set forth above, claim 1 is not rendered obvious under 35 U.S.C. § 103 by Smith in view of Konno,

"If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." MPEP 2143.03; In re Fine, 837 F.2d 1071, 2 USPQ2s 1596 (Fed. Cir. 1988).

Therefore, claims 2-4 and 6 (which depend on claim 1) also are not obvious over Smith and Konno under 35 U.S.C. § 103.

3. Rejection of Claims 5, 7, and 8 Under 35 U.S.C. § 103(a)

Claims 5, 7, and 8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith as applied to claim 4, and further in view of U.S. Pat. No. 3,752,081 to Freeman ("Freeman"). Applicant respectfully traverses.

Claim 5 has been canceled.

Claims 7 and 8 depend on claim 1. For the reasons discussed earlier, Smith does not teach or suggest at least limitations b) and c) of claim 1.

Freeman fails to cure this deficiency of Smith, and the Examiner does not contend otherwise. Therefore, claim 1 is not obvious over Smith and Freeman, under 35 U.S.C. § 103.

"If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." MPEP 2143.03; In re Fine, 837 F.2d 1071, 2 USPQ2s 1596 (Fed. Cir. 1988).

Therefore, claims 7 and 8 (which depend on claim 1) are also not obvious over Smith and Freeman under 35 U.S.C. § 103.

4. Rejection of Claims 9-13 Under 35 U.S.C. § 103(a)

Claims 9-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith, as applied to claim 1, and further in view of U.S. Pat. No. 5,485,086 to Meyer. Applicant respectfully traverses these rejections.

Claims 9-13 depend on claim 1. For the reasons discussed earlier, Smith does not teach or suggest at least limitations b), and c) of claim 1.

Meyer fails to cure this deficiency of Smith, and the Examiner does not contend otherwise. Therefore, claim 1 is not obvious over Smith and Meyer, under 35 U.S.C. § 103.

"If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." MPEP 2143.03; In re Fine, 837 F.2d 1071, 2 USPQ2s 1596 (Fed. Cir. 1988).

Therefore, claims 9-13 (which depend on claim 1) are also not obvious over Smith and Meyer under 35 U.S.C. § 103.

5. Conclusion

On the basis of the foregoing amendments and arguments, as corroborated and supported by the Declaration of Professor Howard S. Taylor and the Declaration of Professor Robert Willcot, filed concurrently herewith, Applicant respectfully

submits that all of the pending claims are in condition for allowance. An early and favorable action is therefore earnestly solicited.

Respectfully submitted,

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